

WHAT IS CLAIMED IS:

1. A method of generating a base comprising the steps of:
  - (a) providing a cation source in a cation source reservoir,
  - (b) flowing an aqueous liquid stream through a first base generation  
5 chamber separated from said cation source reservoir by a first barrier  
substantially preventing liquid flow while providing a cation transport bridge,
  - (c) applying an electric potential between an anode in electrical  
communication with said cation source reservoir and a cathode in electrical  
communication with said first base generation chamber to electrolytically  
10 generate hydroxide ions in said first base generation chamber and to cause  
cations in said cation source reservoir to electromigrate toward said first barrier  
and to be transported across said first barrier toward said cathode to combine  
with said transported cations to form cation hydroxide, and
  - (d) removing the cation hydroxide in an aqueous liquid stream as  
15 an effluent from said first base generation chamber.
2. The method of Claim 1 in which said cation source comprises a cation-  
containing solution selected from the group consisting of a salt solution and a  
cation hydroxide solution.
3. The method of Claim 2 in which said cation-containing solution is  
20 supplied to said cation source reservoir by pumping from a remote reservoir.
4. The method of Claim 3 in which a stream of said cation-containing  
solution is recycled from said cation reservoir to said remote reservoir.
5. The method of Claim 1 in which the volume of said cation source  
reservoir is at least about 5 times the volume of said first base generation

chamber.

6. The method of Claim 1 in which said first base generation chamber is pressurized and the pressure maintained in said first base generation chamber is at least about 2 times any pressure maintained in said cation source reservoir.

5 7. The method of Claim 1 in which said cation source comprises a cation exchange bed including exchangeable cations of the type which form said cation hydroxide.

10 8. The method of Claim 7 in which said cation exchange bed comprises cation exchange resin particles in a stationary bed or suspended in an aqueous liquid.

15 9. The method of Claim 7 in which said cation exchange bed includes a downstream weakly acidic bed section proximal to said barrier and an upstream strongly acidic bed section distal to said first barrier, said upstream and downstream sections being in fluid communication, so that in the migration on the weakly acidic bed section toward the cathode of hydronium ions generated at the anode is slowed in comparison to migration of the cations.

10. The method of Claim 7 in which a source of cation-containing solution is supplied to said cation reservoir by continuously pumping from a remote reservoir.

20 11. The method of Claim 10 in which a stream of said cation-containing solution is recycled to said remote reservoir.

12. The method of Claim 1 in which said cations in said cation source

reservoir also electromigrate through a second barrier to said first base generation chamber.

5 13. The method of Claim 1 including at least a second base generation chamber, and a second barrier being disposed between said cation source reservoir and said base generation chamber.

14. The method of Claim 1 used to form a base eluent for an anion analysis system further comprising the steps of:

10 (e) flowing said cation hydroxide generated in step(d) and a liquid sample containing anions to be detected through a chromatographic separator in which anions to be detected are chromatographically separated, forming a chromatograph effluent, and

(f) flowing said chromatography effluent, with or without further treatment, past a detector in which the separated ions in said chromatography effluent are detected.

15 15. The method of Claim 14 further comprising between steps (e) and (f) the step of:

20 (g) flowing said chromatography effluent through a suppressor including a cation exchange bed to convert said cation hydroxide to weakly ionized form, said chromatography effluent existing as a suppressor effluent which flows past said detector.

16. The method of Claim 15 further comprising, prior to step (e) the following step:

(h) pumping through a gradient pump one or more gradient eluents into said cation hydroxide eluent stream.

17. The method of Claim 14 further comprising pressurizing said chromatography effluent by flow through a pressure restrictor downstream from said chromatography effluent.

18. A method of generating an acid comprising the steps of:

- 5 (a) providing an anion source in an anion source reservoir,
- (b) flowing an aqueous liquid stream through a first acid generation chamber separated from said anion source reservoir by a first barrier substantially preventing liquid flow while providing an anion transport bridge,
- 10 (c) applying an electric potential between a cathode in electrical communication with said anion source reservoir and an anode in electrical communication with said first acid generation chamber to electrolytically generate hydronium ions in said first acid generation chamber and to cause anions in said anion source reservoir to electromigrate toward said first barrier and to be transported across said first barrier toward said anode to combine
- 15 with said transported anions to form an acid, and
- (d) removing the acid in an aqueous liquid stream as an effluent from said first acid generation chamber.

19. The method of Claim 18 in which said anion source comprises an anion-containing solution selected from the group consisting of a salt solution and an acid solution.

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20. The method of Claim 18 in which said anion-containing solution is supplied to said anion source reservoir by pumping from a remote reservoir.

21. The method of Claim 20 in which a stream of said anion-containing solution is recycled from said anion reservoir to said remote reservoir.

22. The method of Claim 18 in which the volume of said anion source reservoir is at least about 5 times the volume of said first acid generation chamber.

23. The method of Claim 18 in which said first acid generation chamber is pressurized and the pressure maintained in said first acid generation chamber is at least about 2 times any pressure maintained in said anion source reservoir.

24. The method of Claim 18 in which said anion source comprises an anion exchange bed including exchangeable anions of the type which form said acid.

25. The method of Claim 24 in which said anion exchange bed comprises an ion exchange resin particles in a stationary or suspended in an aqueous liquid.

26. The method of Claim 24 in which said anion exchange bed includes a downstream weakly basic bed section proximal to said barrier and an upstream strongly basic bed section distal to said first barrier, said upstream and downstream sections being in fluid communication, so that in the migration on the weakly basic bed section toward the anode of hydroxide ions generated at the cathode is slowed in comparison to migration of the anions.

27. The method of Claim 24 in which a source of anion-containing solution is supplied to said anion reservoir by continuously pumping from a remote reservoir.

28. The method of Claim 27 in which a stream of said anion-containing solution is recycled to said remote reservoir.

29. The method of Claim 18 in which said anions in said anion source reservoir also electromigrate through a second barrier to said first acid generation chamber.

5 30. The method of Claim 18 including at least a second anion generation chamber, and a second barrier being disposed between said anion source reservoir and said anion generation chamber.

31. The method of Claim 18 used to form an acid eluent for an cation analysis system further comprising the steps of:

10 (e) flowing said acid generated in step(d) and a liquid sample containing cations to be detected through a chromatographic separator in which cations to be detected are chromatographically separated, forming a chromatograph effluent, and

15 (f) flowing said chromatography effluent, with or without further treatment, past a detector in which the separated cations in said chromatography effluent are detected.

32. The method of Claim 31 further comprising between steps (e) and (f) the step of:

20 (g) flowing said chromatography effluent through a suppressor including an anion exchange bed to convert said acid to weakly ionized form, said chromatography effluent existing as a suppressor effluent which flows past said detector.

33. The method of Claim 32 further comprising, prior to step (c) the following step:

25 (h) pumping through a gradient pump one or more gradient eluents into said acid eluent stream.

34. The method of Claim 31 further comprising pressurizing said chromatography effluent by flow through a pressure restrictor downstream from said chromatography effluent.

35. An apparatus for generating an acid or base comprising:

- 5 (a) an ion source reservoir containing a source of either anions or cations,
- (b) an acid or base generation chamber having inlet and outlet ports,
- 10 (c) a charged first barrier disposed between said ion source reservoir and said acid or base generation chamber, said barrier substantially preventing liquid flow while providing an ion transport bridge for only ions of one charge, positive or negative,
- (d) a first electrode in electrical communication with said ion source reservoir,
- 15 (e) a second electrode in electrical communication with said first acid or base generation chamber, and
- (f) an aqueous liquid source in fluid communication with said acid or base generation chamber inlet port.

36. The apparatus of Claim 35 further comprising:

- 20 (g) a power supply for applying an electrical potential between said first and second electrodes.

37. The apparatus of Claim 36 in which said acid or base generated in said acid or base generation chamber is used as an eluent stream for analysis of ions of interest of one charge only, positive or negative, said apparatus further comprising:

- 25 (h) a sample injection port for injecting a liquid sample stream of

ions to be detected,

5 (i) a chromatographic separator for separating said ions of interest, and having inlet and outlet ports, said inlet port being in fluid communication with said sample injection port and said acid or base generator outlet port, whereby a chromatography effluent exits from said outlet port, and

(j) a detector in fluid communication with said chromatographic separator for detecting the separated ions of interest in said chromatography effluent.

38. The apparatus of Claim 37 further comprising:

10 (k) a gradient pump for pumping one or more gradient eluents into said ion-containing solution generated in said first acid or base generation chamber.

39. The apparatus of Claim 37 further comprising:

15 (k) a flow restrictor in fluid communication with the outlet of said first acid or base generation chamber outlet port.

40. The apparatus of Claim 35 in which said ion source reservoir has inlet and outlet ports, said apparatus further comprising:

(g) a remote reservoir for ion-containing solution having inlet and outlet ports, and

20 (h) a pump for pumping ion-containing solution from said remote reservoir outlet port to said ion source reservoir inlet port.

41. The apparatus of Claim 40 further comprising:

(i) a recycle conduit connecting said ion source reservoir outlet port and said remote reservoir inlet port.



42. The apparatus of Claim 33 in which the volume of said ion source reservoir is at least 5 times the volume of said acid or base generator chamber.

43. The apparatus of Claim 35 in which said cation source comprises an ion exchange bed including exchangeable ions of the type which form said acid or base.

44. The apparatus of Claim 43 in which said ion exchange bed comprises a stationary bed of ion exchange resin particles or resin particles suspended in an aqueous liquid.

45. The apparatus of Claim 43 in which said ion exchange bed comprises a bed of ion exchange resin particles including a downstream weakly acidic or basic section proximal to said first barrier and an upstream strongly acidic or strongly basic section of the same charge as said weakly acidic or weakly basic section and in fluid communication therewith.

46. The apparatus of Claim 35 further comprising a second barrier of the same type as said first barrier disposed between said ion source reservoir and said first acid or base generation chamber.

47. The apparatus of Claim 35 further comprising:  
(g) a bed of ion exchange resin with exchangeable ions of the same charge as said first barrier disposed in said generation chamber between said first barrier and said second electrode and providing an ion path therebetween.

48. The apparatus of Claim 35 further comprising:  
(g) a charged screen of the same charge as said first barrier disposed between said first barrier and said second electrode in said generation

chamber and providing an ion path therebetween.

49. The apparatus of Claim 35 further comprising an uncharged screen  
between said first barrier and said second electrode in said generation chamber.

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